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The Study on Key Performance Indices in National Nuclear R&D Program

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1. Introduction

Korean government has increased its investment of national research and development (R&D) recognizing that science and technology is a core element to bolster national economy and upgrade human life. In addition, measures have been developed to evaluate the R&D performance and contribution as they become critical and play pivotal roles to allocate national R&D budget in order to prevent the spillover effects.

The nuclear technology development program is the backbone of the nuclear R&D programs in Korea. Since the nuclear R&D requires not only massive human resources and capitals but huge research equipments and facilities, the nuclear related science-technology field is usually led by the government because of the high possibility of risk, failure or rewards, the necessity of huge budget, and the research spin-off. The MEST (Ministry of Education and Science Technology) lays the groundwork for the advancement in nuclear R&D and the development of highly advanced technology by securing core technology. In addition, it also fosters world-leading scientists with a creative research environment and an efficient R&D infrastructure**.**

The main purpose of the study is to develop the logic model and design key performance indices for nuclear R&D program. The brief review of basic framework and contents for the performance evaluation system was explained in section 2. Based on the suggested evaluation framework, logic model and key performance indices are provided in section 3 and finally, concluding remarks are given in section 4.

2. Review of Performance Evaluation System in Korea

There has been increased request of enhancing the accountability and efficiency of national R&D programs with increased R&D investment in spite of the limited national resources. Various performance evaluation systems have been devised, modified and introduced to achieve the effectiveness of the individual R&D projects and the transparency of budget spending and allocation, which makes the governmental support for the R&D more feasible. In particular, the advanced countries continue to pursue more efficient governmental system and they have been disseminating performance-based evaluation and management on government activities throughout the world. The policy goals of performance evaluation in R&D can be well expressed in "R&D Performance Management and Evaluation Act" which is enacted in December 2005. It summarizes as follows: The evaluation system of national R&D program should be processed as specific evaluation, self-evaluation and meta-evaluation. Specific evaluation should be independently conducted by NSTC (National Science and Technology Council) and meta-evaluation is conducted based on the self-evaluation by its own ministry. Specific evaluation on current R&D program is carried out on a three year period, or at the request of related organizations. The utilization of evaluation results can be maximized with the relation to performance-based budget allocation system. NSTC promotes self-evaluation by each ministry and research council, and establish the national evaluation system on R&D programs by developing a nation-wide performance system which covers the projects, programs, organizations and innovation capacity evaluation.

3. Key Performance Index for Nuclear R&D Program

On the basis of the governmental performance evaluation system and characteristics of Nuclear R&D projects, logic models to evaluate the performance of the R&D project were reviewed. The model points out both qualitative and quantitative prospects that nuclear R&D projects are evaluated comprehensively. Historically, the Korean National Mid- and Long-term Nuclear R&D Program was launched from 1992 as the 5 year rolling plan. It was updated 3 times so far and now modified into the Five Year Nuclear R&D program. This Nuclear R&D Program is focused on several research fields such as; 1) nuclear technology development program, 2) radiation technology development program and application of radiation and radioisotopes, 3) nuclear energy research infrastructure program, etc. Among those fields, this approach only focused on two programs as: nuclear technology development program and nuclear energy research infrastructure program.

Before the evaluation, the logic model designed complements cause and effect concept to enhance the correlation effects between R&D activity and its outcome. The management of nuclear R&D process contributes to performance effectiveness. In this approach, the processes of nuclear R&D include several

subjects for the design of logic model as shown Fig. 1. In this figure, inputs for R&D refer to human resources, ideas, facility and equipment, requests and funds needed for R&D activities. This process conducted by research groups in university and institution are usually accompanied with R&D projects and are reporting results such as publications. The types of outputs are publications such as paper, patent, new products or processes, knowledge. Finally, the outcomes have to be measured and the degree of accomplishments measures the impact of the R&D program.

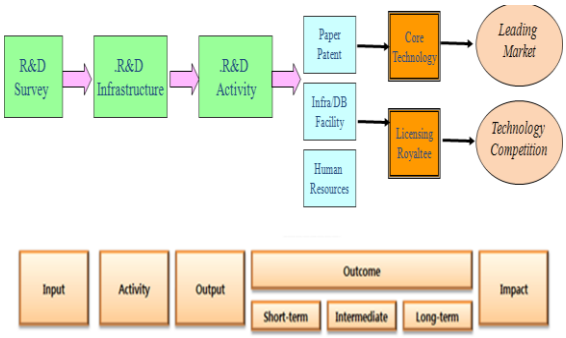

Fig. 1 Logic model for Nuclear R&D program

The measures or evaluation methods of R&D should be different based on the phases or types of the R&D program. The indices of performance evaluation in nuclear R&D should reflect the importance of purpose and objectives of programs. However, it is not necessary to cover all detailed sub-items. In this study, we select several core indices which represent the streamline of nuclear R&D program. Therefore, we take into account three categories as shown in table 1.

(1) Degree of Goal Achievement

To develop a Gen IV nuclear power system technology and pilot project, the Long-term R&D Plan for a Future Nuclear System was established in 2008 by the Atomic Energy Commission. So, primary index is to check the degree of development for future nuclear technology based on long-term milestone. It is reasonable to ensure that the technical issues have been solved and settled and to help improve performance and adapt environmental changes, not just the pursuit of the evaluation. Projects that are far behind schedule or have low achievement process can be investigated in further details. In this poor performance case, it is necessary to find alternatives to modify the plan or find the appropriate explanation by continuously performing the programs, otherwise the budget will be drastically reduced or terminated.

(2) Human Resources Education/Training

To maximize the performance of R&D activity, MEST have relied on the motivation of R&D human resources. In order to identify the performance evaluation index of nuclear R&D capacity, it is necessary to drive them to improve the knowledge and skills, gradually reach the goals. From this perspective, Nuclear R&D has focused on nurturing and cultivating the best engineers and scientists by supporting joint experiment and training course. As second index, we propose the quantity of beneficiaries of education and training as shown second column in Table 1.

(3) Validity of Nuclear R&D Facility and Equipment

Compared to other R&D fields, nuclear R&D must be provided huge facility and equipment. To reflect this feature, we include the survey of satisfaction for nuclear facility users who perform the joint utilization of research facilities such as HANARO or Cyclotron as third index.

Table 1 Performance indices Nuclear R&D with targets and records in 5 years

Performance Index	Target and Records in 5 Years					
	Classification	'09	'10	'11	'12	'13
① Degree of future nuclear technology development	Target	-	-	-	100MWe Prototype Concept, PRIDEProcess, Hydrogen Generation Facility & Helium Experiment Loop	STELLA2 Basic Design, PRIDE Experiment (salt test), Nuclear Fuel Inadiate & Helium Generation Demonstration
② Human Resources Education/Training (persons)	Target	-	-	-	1,784	1,902
	Record	1,413	1,474	1,620	1,784	-
③ Degree of User Satisfaction for Nuclear Facility (score)	Target	-	-	88	85	88
	Record	-	-	83.6	-	-

4. Conclusion

In this paper, logic model and performance indices are developed to investigate nuclear R&D outcomes more efficiently and accurately. The logic model could be used to provide other R&D programs with feedback information for improving their productivity of R&D program. We hope this study contribute to managing the national R&D funds better as long as more novel methodologies could be applied by further research.

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